

CLAIMS

I claim:

1. A mass flow controller, comprising:
 - a flow input port located on a lower end of
5 the controller;
 - a flow output port located on the lower end
of the controller;
 - a sensor unit in fluid connection with the
input port and the output port;
 - 10 a first channel for carrying a first amount
of fluid from the input port to the output port;
 - a second channel for carrying a second amount
of fluid through the sensor unit, wherein the
second amount is less than the first amount;
 - 15 an orifice assembly coupled to the output
port, wherein the orifice assembly has at least
one orifice opening; and
 - a magnetic field generator coupled between
the orifice assembly and the sensor, wherein the
20 magnetic field generator, in response to the
sensor unit, generates a magnetic flux in a
direction from the sensor unit to the orifice
assembly to allow flow through the at least one
orifice opening.
- 25 2. The mass flow controller of Claim 1, wherein
the flow direction through the sensor unit is
approximately perpendicular to the flow direction of
the magnetic flux.
- 30 3. The mass flow controller of Claim 1, further
comprising a bypass assembly coupled between the sensor

unit and the orifice assembly, wherein the bypass assembly comprises grooves to allow fluid to flow through.

5 4. The mass flow controller of Claim 3, further comprising a spring-biased sealing mechanism coupled between the bypass assembly and the orifice assembly and moveable along the flow direction.

10 5. The mass flow controller of Claim 4, wherein the orifice assembly comprises an orifice plate, and wherein the sealing mechanism is located between the bypass assembly and the orifice plate.

15 6. The mass flow controller of Claim 4, wherein the sealing mechanism has openings to allow flow to the orifice plate.

20 7. The mass flow controller of Claim 1, wherein the at least one orifice opening is a central hole.

25 8. The mass flow controller of Claim 4, wherein the spring-biased sealing mechanism seals the at least one orifice opening when no magnetic flux is generated.

 9. The mass flow controller of Claim 1, wherein the magnetic field generator comprises:

 a solenoid core; and

30 a solenoid coil surrounding the solenoid core, wherein the solenoid core comprises a ferromagnetic material.

10. The mass flow controller of Claim 3, wherein the magnetic flux travels through the bypass assembly.

11. A mass flow controller, comprising:
5 an input port;
 a first input channel in fluid connection with the input port;
 a second input channel in fluid connection with the first input channel, wherein the second
10 input channel is smaller than the first input channel;
 a sensor unit in fluid connection with the second input channel;
 a magnetic field generator located between
15 the sensor unit and the input port;
 an output channel in fluid connection with the sensor unit;
 an output port in fluid connection with the output channel; and
20 an orifice assembly located between the magnetic field generator and the output port,
 wherein the orifice assembly has at least one opening and, in response to magnetic flux
 generated by the generator from the sensor unit to
25 the output port, the at least one opening opens to allow fluid flow to the output port.

12. The mass flow controller of Claim 11, wherein the magnetic field generator is located approximately
30 parallel to and at least partially overlaps the first channel.

13. The mass flow controller of Claim 11, further comprising a bypass assembly located between the sensor unit and the output port.

5 14. The mass flow controller of Claim 11, wherein the at least one opening is sealed when no magnetic flux is generated by the magnetic field generator.

10 15. The mass flow controller of Claim 11, wherein fluid flow through the sensor unit is approximately perpendicular to the flow direction of the magnetic flux.

15 16. The mass flow controller of Claim 11, wherein the input port and the output port are located at the same end of the mass flow controller.

20 17. The mass flow controller of Claim 13, further comprising a spring-biased sealing mechanism located between the bypass assembly and the orifice assembly.

25 18. The mass flow controller of Claim 17, wherein the sealing mechanism comprises a ferromagnetic material.

19. A method for controlling flow through a mass flow controller having a flow input, a flow output, a sensor unit, and a bypass assembly and a magnetic field generator coupled between the sensor unit and the flow input and output, the method comprising:

introducing a fluid into the flow input;
generating an electrical signal, dependent

upon a desired flow rate and a measured flow rate,
to the magnetic field generator;

generating a magnetic flux, dependent on the
electrical signal, traveling in a direction

5 approximately parallel to the bypass assembly;

in response to the magnetic flux, adjusting
the position of a sealing mechanism relative to an
orifice to adjust the flow rate through the
orifice; and

10 delivering the fluid out from the flow output
in a direction opposite of the fluid introduction.

20. The method of Claim 19, further comprising
directing a flow through the sensor unit approximately
15 perpendicular to the flow direction through the bypass
assembly.

21. The method of Claim 19, wherein the
adjustment of the sealing mechanism is in a direction
20 approximately parallel to the flow direction.

22. The method of Claim 19, wherein in the
absence of the magnetic flux, the sealing mechanism
seals the orifice.

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23. The method of Claim 19, wherein the magnetic
flux travels through the bypass assembly to pull the
sealing mechanism away from the orifice.

30 24. The method of Claim 19, wherein the magnetic
flux travels through the bypass assembly.